

## Supporting Information

### **Local symmetry engineering and Judd-Ofelt decoupling in SrLaInO<sub>4</sub>:Eu<sup>3+</sup> for high-purity red emission toward advanced solid-state lighting**

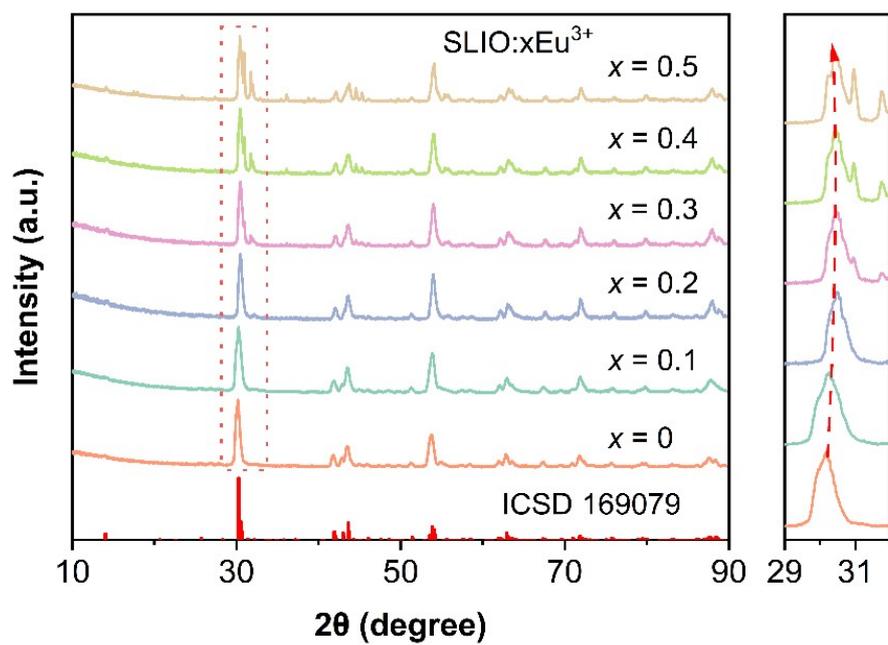
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**Fig. S1.** XRD patterns of SLIO: $x\text{Eu}^{3+}$  ( $x = 0, 0.1, 0.2, 0.3, 0.4,$  and  $0.5$ ) phosphors. The inset shows the zoomed patterns near (113) diffraction peak.

**Table S1.** Rietveld refinement results and structural parameters for the SLIO host and SLIO:0.2Eu<sup>3+</sup> phosphor.

	SLIO	SLIO:0.2Eu <sup>3+</sup>
Space group	Pca2 <sub>1</sub>	Pca2 <sub>1</sub>
a (Å)	12.606(99)	12.555(99)
b (Å)	5.883(28)	5.867(03)
c (Å)	5.846(35)	5.867(44)
α (°)	90	90
β (°)	90	90
γ (°)	90	90
V (Å <sup>3</sup> )	433.625	432.233
R <sub>wp</sub>	6.85%	7.26%
R <sub>p</sub>	4.90%	5.21%
χ <sup>2</sup>	0.978	0.938

**Table S2.** CIE chromaticity coordinates, color purity, and CCT of SLIO: $x\text{Eu}^{3+}$  under 306 nm excitation.

Sample (SLIO: $x\text{Eu}^{3+}$ )	CIE chromaticity coordinates ( $x, y$ )	Color purity (%)	CCT(K)
$x = 0.1$	(0.6505, 0.3414)	92.3	2810
$x = 0.2$	(0.6588, 0.3405)	94.5	2970
$x = 0.3$	(0.6591, 0.3401)	94.6	2989
$x = 0.4$	(0.6601, 0.3393)	94.8	3034
$x = 0.5$	(0.6603, 0.3391)	94.9	3044

**Table S3.** CIE chromaticity coordinates, color purity, and CCT of SLIO: $x\text{Eu}^{3+}$  under 395 nm excitation.

Sample (SLIO: $x\text{Eu}^{3+}$ )	CIE chromaticity coordinates ( $x, y$ )	Color purity (%)	CCT
$x = 0.1$	(0.6548, 0.3438)	93.5	2801
$x = 0.2$	(0.6578, 0.3414)	94.2	2924
$x = 0.3$	(0.6594, 0.3399)	94.6	3001
$x = 0.4$	(0.6599, 0.3394)	94.8	3026
$x = 0.5$	(0.6607, 0.3387)	95.0	3065

**Table S4.** Radiative transition probabilities, radiative lifetimes, experimental lifetimes, and quantum efficiencies of SLIO: $x\text{Eu}^{3+}$  phosphors.

$x$ (mol)	$\text{Eu}^{3+}$ transitions	$A(J, J')$ ( $\text{S}^{-1}$ )	$A_r$	$\tau_r$ (ms)	$\tau$ (ms)	$\eta_{\text{QE}}$ (%)
	$^5\text{D}_0 \rightarrow ^7\text{F}_1$	178.450				
0.1	$^5\text{D}_0 \rightarrow ^7\text{F}_2$	1157.670	1475.744	678	752	>100
	$^5\text{D}_0 \rightarrow ^7\text{F}_4$	139.624				
	$^5\text{D}_0 \rightarrow ^7\text{F}_1$	178.627				
0.2	$^5\text{D}_0 \rightarrow ^7\text{F}_2$	1160.481	1476.645	677	724	>100
	$^5\text{D}_0 \rightarrow ^7\text{F}_4$	137.538				
	$^5\text{D}_0 \rightarrow ^7\text{F}_1$	178.359				
0.3	$^5\text{D}_0 \rightarrow ^7\text{F}_2$	1144.728	1462.213	684	709	>100
	$^5\text{D}_0 \rightarrow ^7\text{F}_4$	139.126				
	$^5\text{D}_0 \rightarrow ^7\text{F}_1$	178.246				
0.4	$^5\text{D}_0 \rightarrow ^7\text{F}_2$	1106.578	1422.591	703	692	98.4
	$^5\text{D}_0 \rightarrow ^7\text{F}_4$	137.767				
	$^5\text{D}_0 \rightarrow ^7\text{F}_1$	178.188				
0.5	$^5\text{D}_0 \rightarrow ^7\text{F}_2$	1074.606	1388.920	719	672	93.3
	$^5\text{D}_0 \rightarrow ^7\text{F}_4$	136.125				